COUNCIL ON FOREIGN
RELATIONS
WASHINGTON, D.C.
THURSDAY, OCTOBER 8, 1992

Thank you, _____.

500 years ago today, Christopher Columbus was having a bad day. After 66 days in the Atlantic, fresh water and good tempers were in short supply. Some of the crew wanted to turn back. They had no way of knowing they were only four days away from fresh supplies -- four days away from the greatest discovery of the Renaissance.

The voyages of Columbus set the stage for more explorers, who mapped the New World, and eventually, the whole world. Queen Isabella's decision to sponsor Columbus still reverberates in the world today, as the language and culture of Spain prevail in most of Latin America.

Ironically, despite three more voyages to the Americas, Columbus never realized what he had discovered. At various times, he thought he was in India, Japan, China, or even the Garden of Eden.

What Columbus did reveal to Europeans, though, was the depths of their ignorance about the world they lived in.

In considering the state of space exploration, I believe we would do well to consider the experience of those European thinkers who read Columbus' account of new lands and began to consider how little they really knew about their world.

We have been dazzled over the years by planetary fly-bys and six trips to the Moon, but what have we <u>really</u> learned? We have not mapped the mineral resources of a single planet, moon, or asteroid. We have not brought back samples from a single planet. We have heard echoes from the Big Bang, but ~~still don't know how old the universe is, or how old our planet is.~~ do we really understand how our universe was formed?

We can now view the Earth from space, but understand very little about how our environment really works.

We don't know whether an increase in carbon dioxide will be absorbed by the oceans, or whether there was a seasonal hole in the ozone layer over the Antarctic in the decades before we had a satellite there to measure it.

We know there is life on Earth, but don't know whether it ever developed on Mars. We don't know if there is life on planets outside our solar system, or even whether there are other planets beyond the nine we know of.

In a world in which computers and television overwhelm us with mere information, true knowledge about our existence is as elusive as ever. Space exploration, if anything, should at least have renewed a sense of ignorance about our surroundings -- ignorance that should propel us toward searching for answers.

Five weeks ago at the World Space Congress, I outlined a vision of what I believe we should accomplish in space over the next twenty years.

This vision is a product of listening to NASA employees, the President and Vice President, members of Congress, academics, industry leaders, international partners, and others. I'd like to briefly describe this vision and what I think it could mean for the nations of the world. This vision is not in final form, but is meant to provoke discussion across the country as we work to develop a shared vision.

To increase our knowledge of the solar system, we should send a series of small and medium-sized robotic spacecraft to all the planets and major moons, as well as some asteroids and comets. Some would be orbiters equipped to map the characteristics and resources of each body, and to gain understanding about how it was formed and how that compares to what's happened on Earth. Landers and rovers would also go to explore the surface in greater detail, and return vehicles would bring back small pieces of these distant worlds for detailed study on Earth.

We'll use a "small is beautiful" approach on these spacecraft. By using cutting edge technology, we'll shrink their size, thereby cutting the launch cost, and allowing the use of powerful rockets to reduce the time needed to reach the outer planets. We'll build them assembly-line style with a common chassis and interchangeability to reduce development costs. And by launching lots of them, if we lose a few, it won't be the scientific disaster it is when you pile everything on one probe every 10 years.

occasionally it will be necessary to build larger spacecraft because of the need for ~~absolute necessity~~ aperture size, ~~needs~~ stopping power or ~~or~~ for simultaneity of measurements to certain astrophysics, remote sensing or planetary missions envisioned. ~~may~~ These large spacecraft should be the exception not the rule.

To study the universe beyond our solar system, the perfect place is the Moon. On its thermally and seismically stable surface, we can build telescopes and interferometers that are orders of magnitude beyond what's possible on Earth and in Earth orbit. On the Moon, night-time lasts for 14-days and there's no atmosphere to cloud the view.

If an interferometer on the Moon were able to image a blue planet with water and oxygen around a nearby star, such a discovery would alter forever our view of Earth's place in the universe.

The Moon may also contain resources that Earth may need some day. We don't know exactly what resources are there, but exploring the unknown always yields the unexpected, and offers unlimited possibilities. And since the Moon is only three days away, it's an ideal place to test the space systems we'll need for the next milestone in human space flight: the exploration of Mars.

The Red Planet beckons us, just as the Moon once did. We have inferred that Mars may have started out very much like Earth, with surface water and a dense atmosphere, thus raising the possibility of life.

New technologies will be needed to send humans to Mars. Nuclear rockets may be needed because of the long distance. A communications lag of up to 40 minutes would mean that the astronauts would be out of touch with Mission Control.

To function independently, they would need large amounts of computerized information, such a medical library, in high density data storage systems, and artificial intelligence to help run and repair the spacecraft. Advanced robotics would probably be needed to maintain their camp and help expand the range of exploration. Life support systems that recycle air and water for two years without contamination would have to be invented.

And ways to counteract bone and muscle loss from lack of gravity would also be needed, as well as other ways to deliver medical care over long distances.

Exploring the Moon, and Mars, and the other planets has a purpose beyond just curiosity. These heavenly bodies may hold vital clues about the past, and the future, of Earth's own environment. For instance, Venus is the same size as Earth, but with a runaway greenhouse effect. Why?

Mars may have had a dense atmosphere and surface water. What happened to them?

Mars appears to have had tectonic & volcanic activity ~~on~~ copious quantities of ~~surface~~ flowing surface water. Does it therefore contain concentrated critical mineral resources?

Shortly after Galileo invented the telescope, observers noted a 70 year period in which there was almost no sun spot activity, and the Earth experienced what is known as the Little Ice Age. How does solar activity affect our climate? As these questions demonstrate, exploring space helps support Mission to Planet Earth, because what's happening in space affects what's happening on Earth.

To figure out the puzzle of global climate change, data on the biosphere must be collected from terrestrial sites around the world. Then from the vantage point of space, dozens of spacecraft will collect complementary data on the atmosphere, oceans, and land, so researchers can figure out the complex feedback of all these natural systems on our climate. It's only after we understand these natural processes and cycles, including how the sun is coupled to them, that we can isolate what effect human activity has on our environment.

From space, you can't see international boundaries. You see the Earth as it really is: a small blue planet in the vast blackness of space. From that vantage point, we begin to realize that we are already on a spaceship -- a planet-sized spaceship called Earth.

America alone cannot complete this vision for scientific exploration that I've sketched -- certainly not in the 20 to 30-year time span I believe is possible.

But if the space-faring nations of the world -- Japan, Europe, Canada, Russia, maybe others -- work together, then we can do it.

Recently, the NASA senior managers were fortunate to have Dr. Deming come talk to us about management. He said without a shared objective, there is no system -- just scattered resources. Then he said a system proceeds by cooperation, not competition.

Now, think about the state of space exploration in the world today. Is there a shared objective? No. So we have no system, just a lot of scattered infrastructure and resources around the world. But take the vision I just outlined, and then think about the fantastic scientific and technological resources that exist in every nation. Could we add them all up and make them greater than the sum of the parts? Yes, if we sit down to work out a system to organize them, all of us will benefit to a greater degree than we are today.

A whole new approach to international cooperation is needed however, than what we've done in the past. Previously, the U.S. has designed a space system, then defined the scientific objectives, then asked other countries to do specific tasks. That's not partnership; that's subcontracting. True partnership means working together from the very beginning to figure out what scientific and technical challenges we want to overcome. Once agreement is reached on the mission concept, it's then relatively easy to figure out who does what.

International cooperation on such a large scale could not be seriously contemplated until this year, after the collapse of communism in the Soviet Union. National security concerns made it impossible for the U.S. and its traditional partners in Japan, Canada, Europe to build the trust needed for a successful partnership with Russia. Now with a democratic Russia seeking new meaning and new uses for its huge space-faring capability, we can take some steps to build that trust.

Although Russia has difficult economic conditions to overcome today, it still recognizes and is committed to its space program as part of its future and national place.

I just got back from a trip to Russia this week -- a follow-up to a longer trip in July. We signed an agreement for joint missions that will improve both our human space flight programs: the flight of a cosmonaut on the space shuttle, an astronaut on Space Station Mir, and docking the American space shuttle with Mir. These missions are scientific, not symbolic, and technically challenging. This agreement can serve as a model of the new kind of international cooperation I'm talking about.

By first gaining agreement on mission objectives and developing a system, we substantially simplified and speeded up agreement on the details.

All these modest steps will serve as confidence building measures -- allowing us to get to know each other -- so we can then determine whether future joint efforts are possible. It is critical to make future efforts multilateral not just bilateral!

Many observers have said the cold war's end has shifted the international battleground to economic competitiveness.

But the first lesson we learn in Microeconomics 101 is that when two people work together, more is produced than with each one working separately. And when we study trade, we learn that every single transaction has to be considered a win-win situation, or no trade occurs.

So if we take these lessons and apply them to building an international system for space exploration, we should proceed on the basis of building win-win relationships where each country feels its contribution is benefiting its own people, as well as the greater good of humanity. As Dr. Deming put it, a good partnership is like a good marriage. The only way the partnership can be judged a success is if both partners help each other "win," otherwise one person ends up married to a "loser."

There have traditionally been three main benefits from space exploration: inspiration, hope, and opportunity. First, scientific discoveries inspire us by creating intellectual food for our minds.

Second, by investing in the space program, we provide hope -- hope that our future will be brighter than our past.

Third, we create opportunity with technological advancements that benefit the economy. Going to Mars will require work in robotics, medical care, light-weight materials, computers, miniaturization, propulsion, and other fields. These developments will ultimately benefit the economy by creating new products and new industries, just as the Apollo program did.

To these three traditional benefits from space -- inspiration, hope, and opportunity -- we now have the chance to add another: a lasting peace.

The Apollo program started out as an extension of the cold war to prove a point. But landing on the Moon and exploring the solar system touched something much deeper in the human psyche all over the world. It spoke to the enduring innate desire to strive to the outer limits of human ability and endurance.

The cold war is now over. As we leave behind a millennium marked by almost constant warfare, the symbolic power of space exploration could bring nations together and make the next millennium one of peace.

Think back to Apollo-Soyuz and that first historic handshake in space. On my trip to Russia in July, I ~~took~~ joined former astronaut Tom Stafford, who commanded that Apollo-Soyuz mission. joined me. Everywhere he went, he was immediately recognized and greeted with hugs and great affection.

The people in both countries who worked on that mission were supposed to be enemies. But as they worked together, and learned about each other, respect -- and then friendship -- grew stronger. Many of those same people will now work to build an even closer partnership in the years ahead.

In Moscow this week, after the signing ceremony, all 37 of us who had worked to make this new agreement happen had dinner together. The camaraderie was palpable, and quite emotional.

Each one of the 37 stood up and gave a toast about the joy they felt -- after so many years of rivalry -- to be actively working to strengthen the peace between our countries.

President Reagan used to say the lack of trust between nations didn't come from being heavily armed; nations were armed because they didn't trust each other. Building the kind of trust across nations necessary for the vision of space exploration I've described today has rarely been achieved in history.

But I believe the nations of the world ~~have matured~~ are maturing and ~~evolved~~ evolving politically, and now maybe it's time ~~to take the first steps~~ to trust each other a little more and ~~work together~~ take the next steps to try working together more effectively. Putting some of the resources and human talent that were dedicated to the cold war into exploration of the solar system and Planet Earth could be one of the greatest monuments to freedom and democracy that we could ever conceive. & with economic, social and other problems sweeping our planet presently, it is difficult to focus on the future. decades out. But if we wish to change ~~the vicious cycle of war and basic~~ ~~needs of war and economic upset~~ in the new millenia, can we not afford to take the risk and try!

There are many more questions than answers

On the Apollo 17 lander, we left a stainless steel plaque that said, "Here man completed his first explorations of the Moon. May the spirit of peace in which we came be reflected in the lives of all mankind." \

Maybe when we get to Mars, we should erect a monument that says, "Built by the free people and democratic nations of planet Earth, who finally united in the spirit of peace \ and set out to discover the unknown together." \\ Thank you.

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REMARKS BY
NASA ADMINISTRATOR DANIEL S. GOLDIN
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Ironically, despite three more voyages to the Americas, Columbus never realized what he had discovered. At various times, he thought he was in India, Japan, China, or even the Garden of Eden. What Columbus did reveal to Europeans, though, was the depths of their ignorance about the world they lived in.

In considering the state of space exploration, I believe we would do well to consider the experience of those European thinkers who read Columbus' account of new lands and began to consider how little they really knew about their world.

We have been dazzled over the years by planetary fly-bys and six trips to the Moon, but what have we really learned? We have not mapped the mineral resources of a single planet, moon, or asteroid. We have not brought back samples from a single planet. We have heard echoes from the Big Bang, but do we really understand how our universe was formed?

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We'll use a "small is beautiful" approach on these spacecraft. By using cutting edge technology, we'll shrink their size, thereby cutting the launch cost, and allowing the use of powerful rockets to reduce the time needed to reach the outer planets. The prediction that missions will take decades becomes a self-fulfilling prophesy. Because everyone thinks it's going to take so long to get to Pluto, they pile everything on the spacecraft until the weight goes up the launch is limited and it could take 15 to 20 years to get there. We'll build them assembly-line style with a common chassis and interchangeability to reduce development costs. And by launching lots of them, if we lose a few, it won't be the scientific disaster it is when you pile everything on one probe and launch it every 10 years.

Occasionally, there may be a scientific reason to build larger spacecraft because of the need for aperture size, stopping power, or simultaneity of measurement, but this would be the exception, not the rule.

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unexpected, and offers unlimited possibilities. And since the Moon is only three days away, it's an ideal place to test the space systems we'll need for the next milestone in human space flight: the exploration of Mars.

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A whole new approach to international cooperation is needed however, than what we've done in the past. Previously, the U.S. has designed a space system, then defined the scientific objectives, then asked other countries to do specific tasks. Russia has done the same and some of our European partners have done the same. That's not partnership; that's subcontracting. True partnership means working together from the very beginning to figure out what scientific and technical challenges we want to overcome. Once agreement is reached on the mission concept, it's then relatively easy to figure out who does what. The way we've worked in America is let's figure out who does what and then we'll get an objective. We need to reverse that.

International cooperation on such a large scale could not be seriously contemplated until this year, after the collapse of communism in the Soviet Union. National security concerns made it impossible for the U.S. and its traditional partners in Japan, Canada, Europe to build the trust needed for a successful partnership with Russia. Now with a democratic Russia seeking new meaning and new uses for its huge space-faring capability, we can take some steps to build that trust.

Although Russia has difficult economic conditions to overcome today, it still recognizes and is committed to its space program as part of its future. They believe that without a space program, they will disappear from the ranks of important nations in the world.

I just got back from a trip to Russia this week -- a follow-up to a longer trip in July. We signed an agreement for joint missions that will improve both our human space flight programs: the flight of a cosmonaut on the space shuttle, an astronaut on Space Station Mir, and docking the American space shuttle with Mir. These missions are scientific, not symbolic, and technically challenging. This agreement can serve as a model of the new kind of international cooperation I'm talking about. By first gaining agreement on mission objectives and developing a system, we substantially simplified and speeded up agreement on the details.

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President Reagan used to say the lack of trust between nations didn't come from being heavily armed; nations were armed because they didn't trust each other. Building the kind of trust across nations necessary for the vision of space exploration described today has rarely been achieved in history. But I believe the nations of the world are maturing and evolving politically, and now maybe it's time to trust each other a little more and work together. With economic, social and other problems currently sweeping our planet, it's difficult to focus on the decades ahead. But if we wish to change the world in the new millennium, can we not afford to take the risk and try? Putting some of the resources and human talent that were dedicated to the cold war into exploration of the solar system and Planet Earth could be one of the greatest monuments to freedom and democracy that we could ever conceive.

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